INDEX TO APPENDIX

A. Definitions

This provides definitions of terminology used throughout the body of the report and is herein included to promote a more complete overall understanding of the analyses performed and the retrofit measures that are recommended.

B. Schematic Plans and Details Depicting Recommendations for Retrofit.

C. Report: "*Seismic protection of Domed Structures" , SIMIN NAASEH, S.E.; ERIC ELSESSER,S.E. Principales,* Forell/Elsesser Engineers, Inc., 160 Pine St. 6th Floor, San Francisco, CA 94111

This report is included as a reference to support the base isolation system as the most effective retrofit scheme for reducing dome amplifications and minimizing the seismic induced lateral loads on the structure as a whole. The report summarizes the evaluation of several historic dome or towered structures including the earlier evaluation of the Utah State Capitol.

D. Base Isolation Track Record Report. Excerpts taken from DIS, Inc. website; http://www.dis-inc.com (printed with permission).

This report summarizes the use of base isolation on several structures that have subsequently been subject to seismic hazards. The report is included as documentation of the effectiveness of base isolation for limiting the amount of damage due to earthquake induced lateral loading.

E. Report: "*Base Isolation: Origins and Development" , NISEE, National Information Service for Earthquake Engineering*, *JAMES M. KELLEY*, Professor Emeritus Civil and Environmental Engineering, Univerisity of California, Berkeley

This report is included as a reference documenting the development and history of base isolated systems for buildings and other structures.

F. Geotechnical Report:"*LETTER REPORT, SITE-SPECIFIC TIME RESPONSE SPECTRA, UTAH STATE CAPITOL BUILDING",* AGRA Earth and Environmental, Inc., Salt Lake City, UT, July 28, 2000.

The information from the geotechnical report is used for the peformance based evaluation of the Utah State Capitol Building based on the analysis guidelines of FEMA 273.

G. Materials Testing Report:"*Material Tesing Services, Existing Material Conditions, Existing Utah State Capitol Building",* AGRA Earth and Environmental, Inc., Salt Lake City, UT, June 12, 2000.

The information from the materials testing is used as the basis for establishing the material strengths and properties that are used in the peformance based evaluation of the Utah State Capitol Building.

H. Excerpt; "The Wasatch Fault", Utah Geological Survey Public Information Series 40, 1996.

This experpt is provided as an additional reference indicating the seismic potential of the Wasatch Front.

DEFINITIONS OF TERMS USED IN REPORT BODY

Accelerogram – A recording of the horizontal accelerations due to ground motions of a specific earthquake or a record of artificially generated accelerations developed from geoseismic engineering for use at a specific site.

Amplification – The phenomenon of increase in horizontal accelerations caused either by increased structural height, irregular vibration behavior or soil conditions.

Base Isolation System – A group of seismic base isolators interconnected by a stiff structural floor (diaphragm) enabling the isolators to act in uniform motion.

Base Isolator – A vertically stiff but horizontally flexible element used to de-couple a structure from the ground thus limiting significant ground motions that transfer into the structure.

Basic Safety Earthquake 1 (BSE-1) - An earthquake having a 10% probability of being exceeded in a 50 year period per FEMA 273 guidelines (See **Design Basis Earthquake**).

Basic Safety Earthquake 2 (BSE-2) – An earthquake having a 2% probability of being exceeded in a 50 year period or a deterministic Maximum Considered Earthquake (MCE).

Basic Safety Objective – The primary rehabilitation goal established by the owner or building official. Per FEMA 273, a Life Safety (LS) level of performance for the BSE-1 and a Collapse Prevent Level of performance for the BSE-2.

Bay – The typical unit of space usually measured from centerline to centerline of adjacent structural columns.

Confinement – Transverse concrete reinforcing bars used to wrap around longitudinal reinforcing bars to hold them in place and prevent them from buckling through the concrete column surface. Also used to hold the core of a concrete column together after cracking.

Damping – The ability of a structure, structural component, or device to absorb earthquake energy so that it become less likely manifest as earthquake load, deformation, or damage.

Design Basis Earthquake – An earthquake having a 10% probability of being exceeded in a 50 year period (See **Basic Safety Earthquake –1**).

Diaphragm – A horizontal planar structural component (floor or roof) that transfers earthquake loads across the breadth of a structure to its primary earthquake resisting elements.

Drag Strut – A beam rigidly connected to a structural diaphragm used to collect earthquake load from a diaphragm and deliver it to the primary earthquake resisting elements.

Ductility - The Ability of a structure to deflect and deform significantly while still maintaining its ability to carry load. In addition, a structure is said to be ductile when it has a high capacity for absorbing and dissipating earthquake energy without experiencing significant structural damage.

Dynamic Characteristics – The natural vibrations of a structure and the manners in which the vibrations become amplified or excited by applied load or applied motion.

Dynamic Load – The forces that a structure and its components experience as a result of earthquake ground motion.

Elastic – The range over which a structural member can be deformed under a specific load and still return to its original shape. The ability of an element to be deformed and then automatically return to its original shape and configuration.

Elastic Displacement – The measured structural deformations due to applied loads that are low enough for the structure to return to its original shape.

Finite Element Method – Method of analysis which considers the various strengths and stiffness of all of the elements of a system and how the elements interact to define the vibrational characteristics and modes of response for the complete system.

Fixed Base System – A structure with a foundation that is cast directly against the earth thus causing the foundation system to be subject to exactly the same earthquake ground accelerations as the adjacent soil.

Fundamental Mode of Vibration – The predominant mode of natural movement for a structure.

Fundamental Period – The time required for the fundamental mode of vibration to complete one cycle of movement.

Global System – The complete building structure in combination with the seismic base isolators and the isolation system.

Inelastic – The range over which a structural member can be deformed under a specific load high enough that the member cannot return to its original shape or configuration.

Inelastic Displacement – The measured structural deformations due applied loads that are too high for the structure to return to its original shape.

Lateral Drift – The measured horizontal displacement of a structure due to applied load.

Lateral Force Resisting System (LFRS) – The structural system included in a building intended primarily to resist the loads and forces that act horizontally on the structure such as wind and earthquake.

Level of performance – The predefined post earthquake damage state of a structure subject to rehabilitation.

Linear – See 'Elastic'.

Linear Behavior – The ability of a structure to return to its original shape and configuration after being subject to a load of certain magnitude. Structural behavior in which member stresses are low enough that the members do not yield.

Maximum Considered Earthquake – A characteristic large earthquake, rare seismic event.

Moment Frame – A lateral force resisting frame that consists only of horizontal beams and vertical columns. Horizontal forces are resisted almost entirely by the bending stiffness of the frame members.

Nonlinear – See 'Inelastic'

Nonlinear Behavior – Structural motions that are high enough to cause the structure to become permanently deformed at a horizontal load of certain magnitude. Structural behavior in which member stresses are high enough that members yield.

Nonlinear Demand – The requirement of a structural system to experience nonlinear behavior for the applied seismic load.

Nonlinear Displacement – The measurable seismic deformations that occur as a result of nonlinear behavior.

Out-of-Plane – The direction normal (perpendicular) to a wall surface.

Out-of-Plane Loads – Forces that act normal (perpendicular) to a wall surface. These loads are usually due to wind or seismic motion.

Passive Damper – A device added to a structure in a configuration similar to a diagonal brace. The device acts as a seismic 'shock absorber' to lessen the impact of an earthquake by absorbing earthquake energy and dissipating it in a safe manner rather than allowing it to become manifest as structural damage.

Performance Based Evaluation – The method of evaluation and design of structures intended to be in accordance with the specific structural performance goals established by the owner or building official.

Performance Objective – The process of selecting an acceptable post-earthquake damage state for a structure then selecting the level of seismic motion for which the acceptable damage state should apply.

Positive Anchorage – The use of specific elements and or devices to connect structural members or structural systems together.

Prescriptive Design – Design in which the primary objective is to follow the letter of the applicable code, usually without regard to the specific performance objective of the owner.

Recurrence Interval – The average statistical time period that passes between occurrences of events that are similar in nature and magnitude.

Response Spectrum – A measure of the extent to which actual or theoretical ground motions have the ability to excite the various natural vibrational modes of a structure resulting in the horizontal acceleration and loading of a structure.

Response Spectrum Analysis – A method of dynamic analysis in which the seismic response of the various modes are combined mathematically to produce a measure of overall structural response to seismically induced ground motions.

Return Period – See 'Recurrence Interval'.

Seismic Demand – The requirement of structural members to perform to a specific level under a certain amount of seismic load.

Seismic Response – The manner in which a structure responds to a specific earthquake ground motion. This is usually measured by overall force, rooftop displacement, or acceleration.

Shearwall – A wall that is designed to resist forces acting parallel to the plane of the wall.

Site Specific – Characteristically unique to the specific building site.

Soil Classification – A measure of the hardness or stiffness of a soil in terms of its ability to transmit shear waves.

Soil Bearing Capacities – The overall capacity of a soil to support a load of specific magnitude.

Shear Wave Velocities – The speeds at which shear waves are propagated through a soil. Usually an accurate measure of the soils ability to amplify the motion of an earthquake.

Static Load – Discrete loads that are applied to a structure that do not move.

Steel Bracing – Diagonal frame members, usually steel, used to prevent oblique deformations in structural frames caused by wind or earthquake loads.

Stiffness Discontinuity – A change in structural strength at a particular elevation that tends to produce a significant horizontal weakness. Sometimes referred to as 'Soft Story' this weakness is often manifest in earthquakes as a collapsed level of a multi-level structure.

Structural Dynamics – The field of structural engineering primarily concerned with the design, analysis and evaluation of structures in response to earthquake or wind induced horizontal motion.

Structural Response – The specific behavior of a structure in response to forces of a specific nature. This is usually measured by overall force, displacement, or acceleration.

Target Displacement – A measure of the total nonlinear deformation that a structure is expected to experience for a predefined level of earthquake motion.

Time History – A record of measured horizontal accelerations from a specific earthquake or those from an artificially generated earthquake produced from geoseismic engineering and analysis.

Time History Analysis – A method of dynamic structural analysis which uses time history accelerograms and applies them directly to the analysis model to determine the seismic response.

Yield – The behavior in a material that occurs when it is loaded beyond its elastic limit and is subject to permanent deformations.

The schematic plans and details shown in this section of the report are a representation of the recommendations herein outlined. This schematic information represents the best thinking and coordination among disciplines in the preparation of this report. Further investigation will be required in pursuit of these recommendations to determine the absolute feasibility along with the best means and methods of achieving the performance and rehabilitation goals.

Full size prints of the following schematic information will be made available upon request.

List of Plans:

S-1 FOOTING AND FOUNDATION PLAN
S-2 FRAMING PLAN AT BASE ISOLATOR LEVEL
S-3 SHEARWALL AND DRAG STRUT PLAN
S-4 DOME PLANS AND SECTIONS
S-5 NEW CONCRETE SHEARWALL ELEVATIONS
S-6 DETAIL SHEET
S-7 DETAIL SHEET
S-8 DETAIL SHEET